A Budget Setting Design Intervention for Reducing Personal Expenses for Chinese Young Generation

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Abstract. In China, the young generation faces the problem of low savings, partially due to their lack of self-control in monetary spending. This paper would like to provide a design solution to reduce this demographic's spending based on a literature review covering such behavioral economics theories as mental accounting and prospect theory. A quantitative research method consisting of surveys and experiments were conducted to collect design insights from users. Our proposed design is a budget setting and spending tracking system in the form of a mobile application and a smartphone case. This system uses a relational display of value and cost to primarily help users reduce spending by setting up a limited budget and facilitate the recording of transactions. Based on user evaluation of the initial prototype, we reflect and summarize a set of strategies for future design for personal finance.

Keywords: Spending control, behavioral economics, personal finance, interaction design.

1 Background

With rapid development of the Internet, China has witnessed an expansion of the consumer market and digital payment systems. However, many cases about Chinese young adults' excessive consumption relying on personal loan and mortgage products and ending up with unaffordable liabilities have revealed some negative consequences of the development. As young adults' living expenses keep increasing, and due to the one-child policy in China, the current young generation may need to be responsible for the expenses – in whole or in part – of all four grandparents and possibly, children in the future, they will face severe challenges in their financial situations.

According to the report from Zhaopin.com in 2018 [1], 21.89% of the surveyed white-collar workers are in debt and 15.57% of white collars have savings less than ten thousand Yuan. Another survey conducted by Zhenai.com in 2019 [2] revealed that, among those among the so-called post-90s generation who are single in China, about 30% of them do not have savings. Financial pressure is the second top (44.84%)

concern of the 2019 survey respondents. On the other hand, another report from Alipay [3] shows different numbers, 92% of the post-90s generation have a surplus every month and 90% will save money every month. It is hard to verify which report is more accurate. The Alipay report did not disclose the exact amount of subjects' saving, the figure of small amount savings can be deduced from the first two survey reports mentioned above. While Chinese young generation has a high awareness of saving money, they are not able to save much. There is a gap between their motivations in saving and their actual capabilities.

To fill the gap, this work aims to improve the financial situation of members of the young generation in China, using design intervention in people's everyday spending habits. Due to the limitation of the regional access and context of our study, all of our study subjects are Chinese; no insight was collected from individuals from other cultural backgrounds. As Chinese people have different attitudes towards wealth, we do not claim our design strategies working for people not from the Chinese culture. Nevertheless, since the theories referenced are universally applicable, we do believe that our strategies provide a good starting point for design for other demographics with a similar goal.

2 Related Work

2.1 Natural Mental Bias

Many researchers have found that humans make financial decisions which does not align with economic principles. Experiments from Chen et al. [4] support that humans have a natural mental bias when making economy-related decisions. These biases are often rigid, but they also provide design opportunities for improving personal financial habits.

Non-fungibility of Mental Accounting. In 1980, Thaler introduced the term "Psychic Accounting," and later this concept was developed into "mental accounting"[5], which refers to people's mental processing in making financial decisions and evaluating the outcomes. People will build and label different accounts mentally for their income and spending. Thaler defined this phenomenon as "non-fungibility"[6]. People will cognitively build different accounts that have their respective operating rules and may interpret different transactions depending on the account where it is applicable.

For example, a person will consider a luxury perfume expensive if he plans to use it for work, but when he is dating a girl and wants to give her a gift, he will consider a perfume at same cost worth the price. It is because the spending on perfume for work can be regarded as a commodity expense, but a gift for a girl will be considered as a relation expense, of which one may have a higher willingness to pay. Although the product and the price are the same, the mental feeling will be different. This is the same for savings accounts - if a person saves some money for further education, he will likely take a mortgage to pay for a car rather than using the savings for education. Although extra interests will be needed to pay, it would be more painful if he used the money which is originally set for education.

Ratio bias: relatively larger number feels more concrete. Experiments [7, 8] have suggested that people have difficulties in processing ratio as opposed to absolute numbers. When buying expensive products, for example, a $100,000 backpack with a discount shown as $1,000 off or 1% off, although the absolute discount is the same, people feel that the number "1,000" is a larger discount. The effect is the opposite when the spending reference number is small, for a $10 pen, a discount as $2 off and as 20% off, "20%" feels a larger discount.

Loss causes stronger feelings than gain. In Kahneman's perspective theories [9], the degree that people feel and perceive loss is more pronounced than how they feel and perceive gain. For the same amount of loss and gain, people tend to have stronger feelings towards the loss.

2.2 The affecting factors for consumption choice after getting the consumption needs

The particular resource account consumers cognitively access will affect their consumption decisions. In 2007, Morwedge and his colleagues [10] found if people cognitively access a larger financial account before shopping, they will spend more compared to a mental access to a small account. They set two groups of people, one group was asked to indicate how many accounts (checking, savings, bonds, stocks, and certificates) they possessed, another group was asked to check their wallet. As a result, the account group spent 36% more than the wallet group. Morwedge et al. consider that there is a fraction that describes consumption choices. The objective cost of an item is the numerator, the account people consider consuming is the denominator. The larger the account is, the smaller the fraction is, and the same item will seem cheaper, thus it is more possible for people to consume.

People need help in relating to their own future. Benartzi and his colleagues [11] found most Americans failed to join the government's retirement plan. Although people have a high awareness of saving for the future, when it comes to action, it is more painful for people to reduce their current assets on hand, than reduce their future prospective assets. So instead of directly asking people to hand over part of income for the retirement plan, they set the choice to "Save More Tomorrow," and part of the salary they ought to receive will be redirected to the retirement plan beforehand. This helps many people to join the plan and therefore have savings. Goldstein, Hal and Allianz investigated saving behaviors in relation to how people viewed their future self and referenced the philosopher, Derek Parfit, who mentioned that people tend to neglect the future self, due to a lack of imagination [12].

The wealth used for consumption: current income has a higher marginal propensity to consume. Shefrin and Thaler raises the theory that people will construct three mental accounts for their economic resources: *current income*, *current assets*, and *future income*. *Current income* is associated with the highest marginal propensity to consume, while *future income* is associated with a lowest one (cf. [13]). Thus, people tend to spend *current income* more easily. When the income resource remains the same, but a person puts more money into the *current assets* account, less money will be put into *current income*, therefore there would be less spending.

The feeling of paying and consumption: the closer timings in between payment and consumption, the more pain. Many observations have supported the double-entry mental accounting theory raised by Prelec and Loewenstein: time is an important factor to consider in the consumption process; the closer the consumption happens around the payment timing, the more painful the consumption will feel [14]. People tend to spend more when the consumption feels less painful.

These related works of behavioral economics and the theories they have put forth heavily inform the design direction of our work.

3 Research Design

In searching for strategies for creating interventions to enable young adults to improve their savings, we first took a broad look at the current design solutions in the mobile application market as it is one the most concentrated areas for personal finance products, especially in China. We investigated a range of 12 different mobile applications from the Chinese market and a few from international market (i.e., listed in app stores across multiple countries). The majority of these products are bookkeeping applications, such as Shark Keeping, Alipay Bookkeeping; a few of them have other functions such as selling financial products, bookkeeping through conversations. We can rarely see in these products application or usage of any of the above highly relevant behavioral economic theories. They appeared to us to be tedious to use and difficult to persist the usage for a long time.

This observation prompted us to come up with a two-phase iterative research design. In the first phase, we collected responses on user experiences and issues with current solutions through surveys and identified the key problems and gaps. We then in the second phase to target at these key issues with a set of iterative experiments, each embedded with varied solutions, and tested their efficacies in an experimental study. In the following we will introduce each study with the details of study design and its results, with each study design built on top of the knowledge gained from the previous study.

4 Study 1: Surveys of People's Financial Habits and Experiences with Current Solutions

In the first phase of our research, surveys were chosen in order to understand people's habits, rationales and attitudes towards spending. Open-ended questions were designed to get more qualitative insights.

4.1 First Survey: Current Accounting Tools Are Not Efficient in Helping Self-finance-management

It is commonly considered that, to accumulate assets, it is important to track one's income and spending and reach a balance between them, usually with the help of

accounting tools. To have a basic understanding of people's self-financial-management behaviors, we conducted a short survey about accounting tools. This survey was initially posted on a personal WeChat Moments (i.e., timeline posts) entry and was reposted by personal connections.

The survey first asked participants about their existing sources of income and financial resources for later analysis. In the second part we asked if they have experience with accounting tools. For people who have the experience, they were asked to write down the reasons for using the tools. If they have stopped using the tools, they were also asked for the reasons behind the decision. The survey also wanted to see if the degree of financial resources had a relation with accounting tool usage.

The survey collected 70 effective responses through snowball sampling, with 48 participants having their own incomes, and 22 participants not. They have shown similar financial awareness: both groups have about 60% of people who have used accounting tools before (62.5% and 59.09% respectively) and both have the same top reasons for using the tools. The answers to the question of asking why they use accounting tools were theme-coded, "know where the money goes" is the top reason with 42.86% of people mentioned and "want to control own spending" is the second reason with 28.57% people mentioned (see Fig.1).

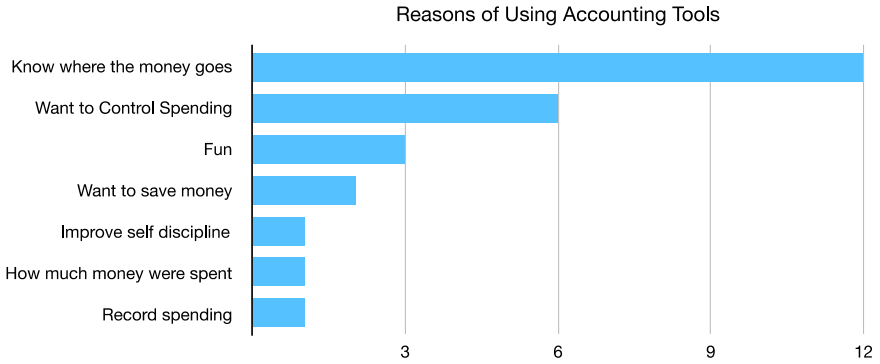

Fig. 1. Respondents' reasons for using accounting tools

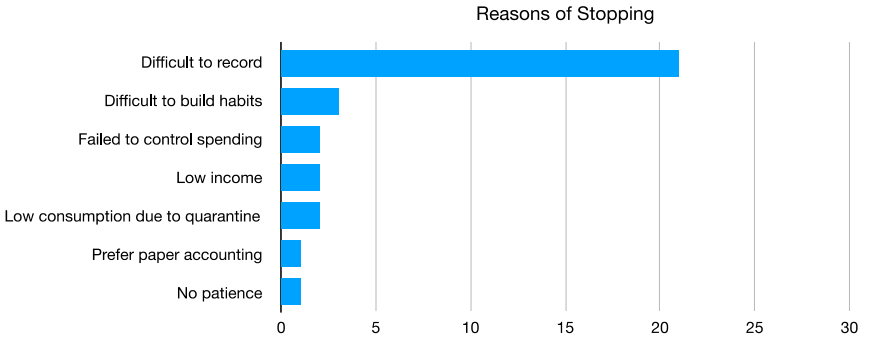

Fig.2. Respondents' reasons for stopping using accounting tools

Among the participants who have used accounting tools, 67.44% of people (29 samples) have stopped using them. 75.86% of them mentioned the difficulties of using the tools ("too lazy to book each spending", "always forget to book", "the process is too complicated", "It is too troublesome and difficult to keep on recording each spending" etc.). 9% of people considered that the accounting tools cannot help with control their spending (see Fig.2). Following a short interview with these participants, an interesting insight was drawn: even they successfully recorded the spending, they felt that most of their spending is rational and so they still consumed in the same way.

One possible interpretation of the survey data is that many participants considered accounting tools useful for improving spending and saving habits, but they failed to continuously use the tools due to the usability issues and their effectiveness. Some participants found only *tracking* the spending alone is not effective in helping to control their spending. To help people build a healthy financial habit, therefore, new approaches rather than merely tracking should be considered. Our first survey shows that it is challenging for many to control spending as people tend to self-rationalize their purchases.

4.2 Second Survey: The Type of Spending That People Are Willing to Reduce

After a refocusing from the broad first survey results, we conducted a second survey to understand the deeper attitudes of people towards their spending. In this survey, participants were asked about their age and if they ever had the feeling of "being poor." People who had had the feeling of "being poor" were then asked to choose the reasons for this situation. For people who chose "love spending" as the reason, they were asked to write down any type or example of spending that they thought could be reduced.

The survey has collected 160 effective samples. 136 participants have had feelings of "being poor", 66 of them are aged from 20 to 25, 40 of them are from 25 to 35, and 30 of them are above 35. Different age groups revealed different choices patterns for the reason.

30.3% of people aged 20 to 25 groups consider "love spending" as the reason, 27.5% of participants aged from 25 to 35 have the same considerations, but only 6.7% of people who are above 35 have the same problems. This supports that controlled spending tends to be more effective in helping younger people to achieve saving assets. While for older people, probably due to the fact that they have a more mature financial awareness and self-control, they do not have much trouble in spending. For the portion of spending which can be reduced, the answers were theme-coded, "shopping" and "eating" are the top two choices with 15 and 13 people choosing separately. Other mentioned types were "game", "entertainment", and "social" (see Fig.3).

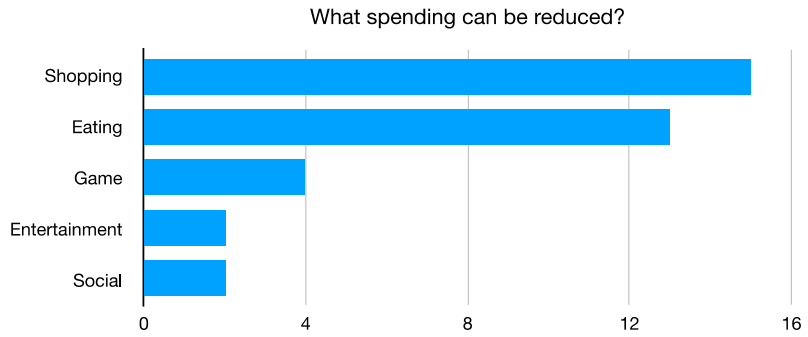

Fig.3 What spending respondents think can be reduced

According to the study from Li et al [15], Chinese people build four mental accounts for determining their spending: commodity expense account (referring to the necessary daily spending: clothing, transportation, telephone bills, etc.), development expense account (referring to family and development sending: real estate, car, etc.), relation expense account (referring to donating, gift and another spending for maintaining relationships with others) and hedonic expense account (the spending for relaxation and entertainment, which improves their living quality). It can be seen that the boundary between commodity expense and hedonic spending is blurry and dependent on the situation. When people buy clothes, if they are the cheap ones for basic wearing, it will be the commodity expense, but if they are fancier clothes for a stylish look, the clothing will be a hedonic expense. From the results of the survey, among the spending most participants choose to reduce, "shopping", "game", "entertainment" can all be grouped as hedonic expense, "eating" can both be commodity and hedonic, so the spending worth controlling will be a hedonic expense and hedonic related commodity expense.

4.3 Limitations of the survey

Given the online mode of survey distribution, we could not encourage participants to write in more detail, so most of them have written only a few words in the answer. Thus, the result cannot cover the participants' deep value on certain behaviors, which limits us in drawing strong conclusions.

The wording "love spending" in the second survey cannot be fully interpreted as people's failure to control their own spending. It cannot directly prove that younger people have less control in self-control, but possibly only show that they may be more willing to reduce the amount of their spending to maintain a better financial situation.

5 Study 2: Design-oriented Experiments

In the second phase of our research, we focus on generating promising strategies as design intervention, by drawing insights from both our survey results and relevant behavioral economics theories we reviewed previously. Given the rapidly growing and dominating trend of digital payments in China and other Asian countries like South

Korea, we consider digital payment is the design space where we could effectively place our intervention. In this phase, we first identify a set of key design considerations based on the survey results. We then conduct an iterative experiment-based study to verify and fine-tune a number of key strategies derived from those design considerations.

5.1 Design Considerations

Replacing cash payment with digital is now the trend. What comes with this is that people now tend to spend more money. Prelec and Simster [16] argued that when using credit cards, people have a higher willingness to pay. The reason behind may be due to the fact that when using credit cards, people refer to their credit card limit, which is a much larger amount compared to the amount they pay in cash payment. Another reason is that the feeling of paying happens in repayment, the moment when one has to pay the credit balance after the consumption. The digital payment has a similar problem, probably due to the fact they are often associated with credit card. This trend is not likely to be reverted as it may cause inconvenience as the society develops.

Within the context of digital payment, we identified five design strategies based on the existing theories as well as findings from the surveys. First, help users *to plan a rational spending account and a saving account*, so people will be less likely to spend too much (exceed the numbers set in the spending account). Second, *give consumption consequence hints both in absolute numbers and proportions*, with adjustment of the showing mode according to the spending behaviors. Third, help people to build *a financial plan related to their future*. Fourth, *build accounts with smaller relative amounts* for people to refer to when purchasing. Lastly, the intervention ought to focus on *only hedonic and hedonic-related commodity expense*.

5.2 Experiment 1: A Pre-test and Post-test Activity with an Attempted Intervention in-between

Drawing from the above considerations and findings of Morewedge et al. [9], the design intervention should focus on suggesting users to *use a small number as a spending reference mental account* so they will spend less on daily consumptions. To test the effectiveness of this key strategy, we conducted two experiments. The first one is a daily budget with a future plan. It serves as a mental restriction for people's spending. This first experiment only displays the budget for daily expenses, so the amount of the mental account is small.

16 architects were recruited for the experiment. They were all based in Shanghai and Shenzhen as these two cities have similar income and consumption levels. The same working industry was chosen to minimize the effect caused by participants' different income and work-life modes. The experiment consists of three parts. Due to the pandemic and geographical restriction, the experiment was conducted online. To save time, participants were gathered in WeChat groups. A link with a survey form which included the contents of the experiment were sent in the group.

Part 1: The auction (pre-test). This part of experiment design followed the experiment conducted by Prelec and Simester [16]. At the beginning, all our participants were asked to offer a price for three things (Pre-test):

1. Uncertain market price (higher value) – A redemption ticket for a VIP concert ticket;
2. Uncertain market price (lower value) – A redemption ticket for a celebrity signed album;
3. Certain market price – A 100 CNY Alibaba Group product coupon.

The uncertain market price items were auctioned with the Second Price Sealed Bid Auction-participants do not know each other's offering. The highest offering price wins the auction, but only need to pay for the second-highest offering price. The certain market price item was auctioned with the Becker-DeGroot procedure – while participants do not know each other's offering, a random participant will be chosen and the system will generate a number from zero to the face value of the auction item. If the chosen participant offers a higher price than that generated number, he wins and pays his offering price. Otherwise, this process will be repeated until a winner is found. Both auction rules are considered effective to measure people's willingness to pay.

Part 2: Survey embedded with attempted intervention. After participants offered the price of the three items first (Pre-test), they were invited to fill out a survey. The survey started off with basic information, such as the salary increasing level in their industries in the cities, the cost of real estate, and so on. They were then asked to set a savings goal for themselves when they reach 35 years old. According to the saving goal, participants were asked to calculate and set a daily spending budget for now.

Part 3: Auction again (post-test). After setting the two financial numbers in part 2, participants were asked to go for the price for the same items in the second round (Post-test). The financial calculation process was considered as financial education for the participants, and people would offer a lower price in the second round in reference to the daily budget. If the second-round auction price is lower, it can support that the "daily budget" strategy is effective to control people's willingness to pay thus reducing the amount of spending.

Results. All participants offered the same price for concert tickets (higher value uncertain market price) and coupon (certain market price) in both rounds. Only very few offered lower prices for the album (lower value uncertain market price). After the test, we did short interviews with some the participants, trying to understand why they did not seem to be affected by our "attempted intervention." We asked about their feelings about the education process. The saving goal and budget setting did make participants reflect on their current spending habits. However, the auction items do not belong to daily spending in their mind, so they did not use the daily budget as the reference when deciding the price. They came up with a price based on their understanding of the value of the items and their overall financial situations (mainly income). This result showed us the need to emphasize "daily budget" more with additional elements to augment the perceived impact. We thus adjusted our strategy to

include both daily budget and monthly hedonic budget. It is further tested in the second experiment.

5.3 Experiment 2: Controlled Experiment

40 participants, from different industries this time, were recruited, all of whom were, again, based in Shanghai and Shenzhen. For the purpose of a controlled experiment, they were manually separated into two groups so people with the same background will not be in the same group. Participants were asked for their current monthly spending before being exposed to the experiment.

The experiment group was supported with a suggested spending budget form, which suggests different spending budgets for different income levels. We claimed that the suggested budgets were calculated based on the average salary increase rate of the participants' respective industries in their living areas, by following the spending suggestions, they can obtain a good financial savings for future demands. On the other hand, the reference group had no suggested form (i.e., no intervention). Both groups were asked to determine the daily budget and monthly hedonic budget (related with the suggested form or not) according to their own situation. After setting the budget plans, they were asked for consumption choices under different scenarios:

1. It is a lunch break of the day. You want to order food delivery for yourself. What price range will you choose? (Commodity scenario)
2. You finished a big project today. You would like to celebrate it with your friends/partners. You want to have dinner and have some them. What price range (per person) of a restaurant will you choose? (Hedonic scenario)

The results showed no clear pattern for the two groups (see Fig.4, 5, 6). No pattern showed that people who have a higher income will spend more, but people in different industries show different spending habits. For instance, the participants who work in the art industry spend more than others despite having lower income.

Short interviews were conducted with four participants in the experiment group to understand the mental process of dealing with the budget. A participant thought that the budget was higher than his current spending habits, so for commodity spending, he did not make any difference as it was already his routine habit. However, for the hedonic scenario, he raised the amount of his spending compared to his usual habits. One revealed that as the experiment was conducted in a survey format of which he does not feels serious about it, so he just finished the survey quickly with his current habits without much consideration about being given a budget. Another two participants indicated that the budget had affected their spending choices. They combined the suggested number with their current spending habits and came up with the average choice. The interview results gave us many explanations that the statistic results could not tell us.

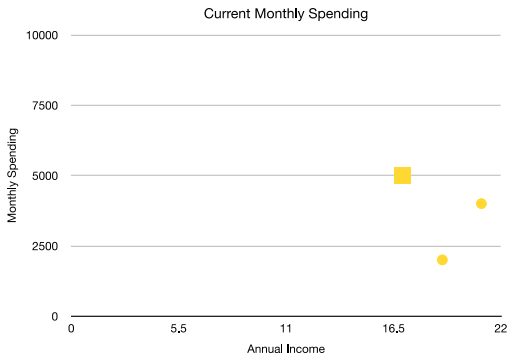

Fig.4 Respondents' current monthly spending with their income (numbered in thousands)

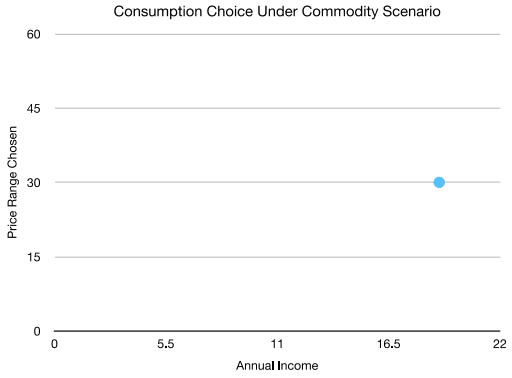

Fig.5 Respondents' consumption choice under commodity scenario with their income

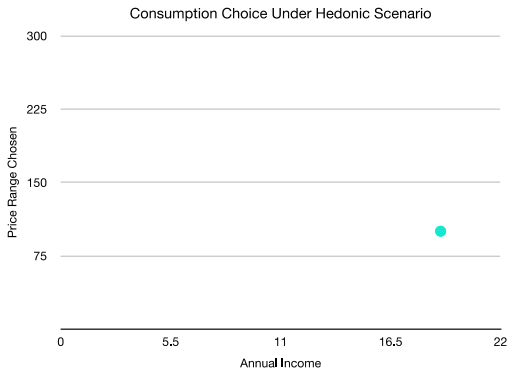

Fig.6 Respondents' consumption choice under the hedonic scenario with their income

5.4 Lesson Learned

According to the findings from the experiment, income and spending habit are not always directly proportional. Thus, when help to build a rational spending account, each individual's habit should be considered. Otherwise, the suggesting plan may be too difficult to follow, the users will easily be frustrated and give up.

6 Design Concept *BUDG* and Its Initial Feedback

Although both experiments did not show promising results, some insights were taken. Drawing from insights and considerations built from both literature review and our empirical studies, we incorporate the key strategies into a design concept called *BUDG* that includes a mobile application and a smart phone case. We then implemented the concept in a low-fi prototype. The app will help the user to create a budget plan (daily budget and monthly hedonic budget) and record the user's spending. The phone case aims to provide a strong visual hint of the balance situation of the budget. As the mobile phone is usually the most frequently used item in people's lives, and will become an increasingly important platform for payment, a phone case can be a reminder for spending control since it is always with the user.

The phone case uses lightning to connect with the phone, they will work together to auto-track user's consumption. For other payments not conducted by phone, the user can manually record the expense. A "Quick Record" feature helps the user to quickly record routine spending without going through the complete recording process. There are two light strips on the sides of the case to serve as a visual reminder. One stands for daily budget balance, another for hedonic budget balance (see Fig.7).

6.1 Budget Planning

The first time the user logs in BUDG, the system will collect the user's income, working city, daily spending habits, other fixed spending items, and ask the user to set a future saving goal and their expected time to achieve. The user's total wealth accumulation during this time will be estimated according to the salary level of the industry in the city that the user lives in. The daily budget will be suggested according to the average consumption level or remain the same as the user's current habits (depending on which one is lower). After deducting the target saving amount, daily routine spending, and fixed spending, the rest amount will be set as the Monthly Hedonic Budget. Users can still edit the suggested budgets according to their situations. When the user changes one budget item, the other budget items will be changed automatically by the system in accordance in order to keep the saving goal still achievable

For example, a user may set a goal of buying a 100 thousand dollars car in 5 years, and the system suggests a daily budget of 100 dollars and a hedonic budget of 6,000 dollars for every three months. The user may consider 100 is not enough for spending and changed the number as 120 dollars, then the system will adjust the hedonic budget accordingly to 4,800 dollars, so the 100 thousand dollars saving can still be saved in 5 years.

The budget setting is mainly to help the user build a rather small mental account for daily and hedonic expense before the consumption. People will refer to this account when buying in-situ, rather than referencing to their current income, digital account (which usually saves a large proportion of total wealth) or a fuzzy wealth impression coming from the credit card limit. Relating to the future saving goal helps users better prepare for the future.

6.2 Budget Balance

The money spent will be highlighted on the homepage of BUDG to keep users aware of each spending. It attempts to cause a lasting painful experience of spending in the users and to urge them to spend less in the future. The amounts of spending display in two modes: absolute numbers and a balanced proportion in percentage (see Fig.7).

The threshold of the changing effects of absolute number and proportion in ratio bias effect has not been discovered. So currently, in the design, the consumption of hedonic budget which usually is a higher absolute cost will be shown as an absolute number. Spending in the daily budget which is usually a relatively lower absolute number will be shown in percentage. When half of the budget is spent, an exclamation mark will reveal to remind the user to be thoughtful for the next consumption. If there is a surplus in the budget, the user can choose to set a "reward account" for himself or move the surplus to next month's budget.

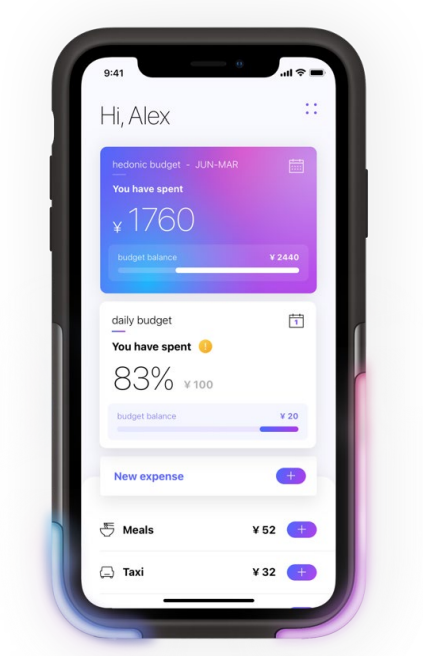

Fig.7 The phone case and the app homepage which reveals the budget balance

6.3 Spending Recording

Users can record their spending manually. To simplify the recording steps, the user only needs to choose first-level spending categories and the amount of spending. They can add more details by unfolding the menu to choose the second-level category and add some notes. According to Chinese people's expense mental account, the four first-level categories are: commodity, relation, development, and hedonic. Commodity expenses are divided into the high-frequency "daily expense" and low-frequency "commodity expense."

Users can choose to set a record as "quick record." The quick record will be listed on the homepage. By clicking add and confirm, the same record will be made. Only the consumed amount can be changed in the quick record pop-up. For frequently repeated spending like routine transportation costs, users do not need to go through the whole record process.

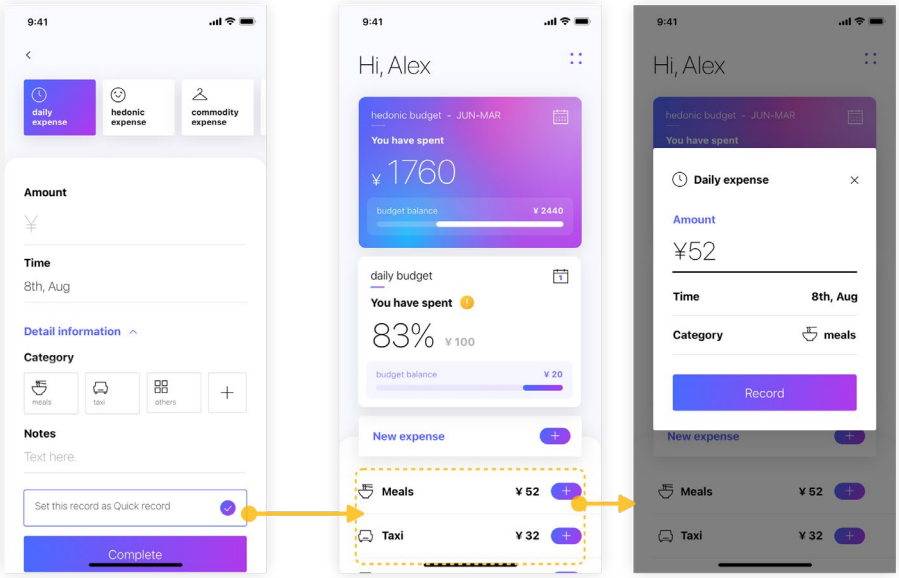

Fig.8 Quick Record

6.4 Auto Recording

All the spending through digital and bank accounts will be automatically recorded after the user connects the app with their financial account. There will be notification pop-up every time when a consumption is detected. A permanent reminder will stay on BUDG's notification page, together with the light strips on the phone case to remind users of the budget balance situation and increase the feeling of losing their wealth. If no expense is detected during the day and no manually expressed record is added, the app will push a notification to the user, reminding them to record today's expense at

night. If till midnight there is still no record, the system will automatically eliminate a full day daily budget amount in the record. User can change this record later.

6.5 Initial User Testing

Three people were invited separately to participate in the initial user testing that are done under the COVID-19 pandemic situation - remotely via screen sharing of the UI prototype with the researcher acting on users' behalf. Participants are highly attracted by the colorful light strip phone case which they consider "cool", "give a sense of science." They consider this will attract them to use the system. They think auto-tracking and "Quick Record" are effort-saving which can help them to keep using the product finally achieve the saving goals. One participant did question the technical feasibility of incorporating a person's other financial accounts into the app, which will be a concern for our next stage development. Some modifications in the UI are made after the testing:

1. The original hedonic budget is only set for one month. One participant suggests he does not spend in hedonic expense monthly but two or three months. So, the suggested hedonic budget in the system can be set manually to calculate as "monthly" "every three months" or " half a year."
2. The saving goal set in the beginning is only for urging users to spend less, but not strictly a wealth accumulation system. So, the progress of how much users have achieved in the saving goal is not displayed. The participants think even the process is not strictly accurate, it is still encouraging to keep on controlling the spending if they have a feeling of saving money toward a target. Thus, the display of the process of money been saved is added (estimated saving calculated from user's estimated income and spending recorded).
3. The item in the manual record page is simplified. The manual record used to have a "merchants" column, but participants reveal they do not care about the merchants, or they can add this content in the "Note" area. So, this item is removed.

7 Conclusion and Future Work

In this paper, we argued that design intervention is needed for the Chinese young generation to control their spending to improve their financial situations, as they have the motivations to reduce certain types of their expenses but lack the capability in practice. Hence, our proposed design solution is focused on controlling the willingness to pay. The design to control spending relates to the users' saving goals and future plan. The key strategies carried into the BUDG design concept are to make users feel more on their expense and to foreground and highlight their spending mental account with visual hint and UI design in the app.

Although our design-oriented research showed promise in applying behavioral economics principles in personal finance design, our empirical studies reveal a real challenge in seeking a universal strategy that works for everyone. Our study findings suggested that an effective solution needs to be versatile and intelligently catered to

each individual's situation. Nevertheless, our study results critically paved the way to the formation of a more sophisticated, personalized solution, as we found the individual differences tend to come from detailed threshold figure setting and the priority of different budget items.

In our future work, a more functional and higher-fidelity prototype for BUDG will be developed with refinements in personalization. We plan to conduct longitudinal user study on our target audiences; namely, people who do not have savings due to difficulties in controlling their spending. They will be invited to use the prototype in longer terms while the behavioral data, real saving amounts and cognitive feedback will be recorded after different period of time: a week, a month, three months and half a year. The results will be compared with their spending habits before and are expected to support the effectiveness of the budget intervention. Moreover, additional design features such as goal setting and habits building will also be considered to reinforce the original concept and make the design suitable for long-term use.

References

1. Zhaopin.com (2019) 2018 Bai ling man yi du zhi shu diao yan bao gao [Intervention for Reducing Personal Expenses for Chinese Young Generation]. 199IT. http://www.199it.com/archives/818240.html.
2. Zhenai.com (2019) 2019 90 hou dan shen ren qun bai pi shu [2019 White Book for single after 90s].199IT. http://www.199it.com/archives/989643.html.
3. Chao Hui (2019) Zhi fu bao fa bu shou fen 90 hou zan qian bao gao: 90 hou chu ci li cai bi fu mu zao le shi nian [Alipay published the first money saving report of after 90s: there first investment is 10 years earlier than their parents]. http://news.mydrivers.com/1/638/638499.html.
4. Chen MK, Lakshminarayanan V, Santos LR (2006) How Basic Are Behavioral Biases? Evidence from Capuchin Monkey Trading Behavior. J Polit Econ 114:517–537. https://doi.org/10.1086/503550
5. Li A, Ling W (2007) Mental Accounting: Theory and the Application Inspiration. Adv Psychol Sci 15:727–734
6. Thaler RH (2008) Mental Accounting and Consumer Choice. Mark Sci 27:15–25
7. Kirkpatrick LA, Epstein S Cognitive-Experiential Self-Theory and Subjective Probability: Further Evidence for Two Conceptual Systems. 11
8. Burson KA, Larrick RP, Lynch JG (2009) Six of One, Half Dozen of the Other: Expanding and Contracting Numerical Dimensions Produces Preference Reversals. Psychol Sci 20:1074–1078. https://doi.org/10.1111/j.1467-9280.2009.02394.x
9. Tversky A, Kahneman D (1981) The framing of decisions and the psychology of choice. Sci Am Assoc Adv Sci 211:453–458. https://doi.org/10.1126/science.7455683
10. Morewedge CK, Holtzman L, Epley N (2007) Unfixed Resources: Perceived Costs, Consumption, and the Accessible Account Effect. J Consum Res 34:459–467. https://doi.org/10.1086/518540
11. Thaler RH, Benartzi S (2004) Save More Tomorrow™: Using Behavioral Economics to Increase Employee Saving. J Polit Econ 112:S164–S187. https://doi.org/10.1086/380085
12. HAL E. HERSHFIELD, DANIEL G. GOLDSTEIN, WILLIAM F. SHARPE, et al (2011) Increasing Saving Behavior Through Age-Progressed Renderings of the Future Self. J Mark Res 48:S23–S37. https://doi.org/10.1509/jmkr.48.SPL.S23
13. Antonides G, Ranyard R (2017) Mental Accounting and Economic Behaviour. In: Ranyard R (ed) Economic Psychology. John Wiley & Sons, Ltd, Chichester, UK, pp 123–138
14. Li A, Hao M, Li L, Ling W (2013) A New Perspective on Consumer Decision: Double-entry Mental Accounting Theory: A New Perspective on Consumer Decision: Double-entry Mental Accounting Theory. Adv Psychol Sci 20:1709–1717. https://doi.org/10.3724/SP.J.1042.2012.01709
15. Li A, Ling W (2007) The Implicit Structure of Mental Accounting among Chinese People. Acta Psychol Sin 39:706–714
16. Prelec D, Simester D Always Leave Home Without It: A Further Investigation of the Credit-Card Effect on Willingness to Pay. 8